昆虫学报 *Acta Entomologica Sinica*, December 2003, 46 (6): 755 – 760 ISSN 0454-6296

The genus *Cinygmina* (Ephemeroptera: Heptageniidae) in China, with a description of a new species

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Abstract: Chinese members of the genus *Cinygmina* are reviewed. Four known species (*C. hunanensis*, *C. obliquistrita*, *C. rubromaculata*, *C. yixingensis*) and one new species (*C. furcata* sp. nov.) are compared, described and illustrated. One new synonym, *C. rubromaculata* (= *C. hainanensis*) is established.

Key words: Ephemeroptera; Heptageniidae; *Cinygmina*; new species; new synonym; China

The genus *Cinygmina* was established by Kimmins (1937) based on imagos of *C. assamensis*. The larval characters of this genus were first reported by Jensen (1972). You *et al*. (1981) and Braasch and Soldán (1984) discussed and defined its generic characters.

Jensen (1972) argued that this genus was related to the *Afronurus*. However, Tshernova *et al*. (1986) and Kluge (1988) demoted it to the subgenus of *Ecdyonurus*. We followed the original generic rank of *Cinygmina* here based on characters of both imagos and larvae that are unique within the Heptageniidae. The males of this genus can be distinguished from other heptageniids by plate-like titillators or the absence of them and relative longer basal segments of foretarsi (0.6 – 0.9 times as long as segment 2). The larvae possess unique gills: dorsal lamellae of gills 5 – 6 with additional projections (Fig. 8).

Although the genus has only 13 known species so far (Braasch 1990; Braasch and Soldán 1984, 1987a, 1987b, 1988; You *et al*., 1981; Wu and You 1986; Zhang and Cai, 1991), it has been found from India to the Russian Far East (Kimmins 1937; Braasch and Soldán 1984, 1988; Tshernova *et al*., 1986). In China, this genus has been collected frequently from Hainan Province to the suburbs of Beijing municipality, and has been preliminarily studied by Wu *et al*. (1986), Zhang and Cai (1991) and You and Gui (1995). In southern and eastern China, *Cinygmina* larvae are usually the dominant heptageniid population of benthic invertebrates, and larvae of several species usually live in the same habitat. In order to facilitate identification and to improve on previous inadequate descriptions, we recently reexamined all *Cinygmina* types and specimens in our collection. One new species and one synonym are erected here, and the key characteristics of the other 4 known species are briefly reviewed.

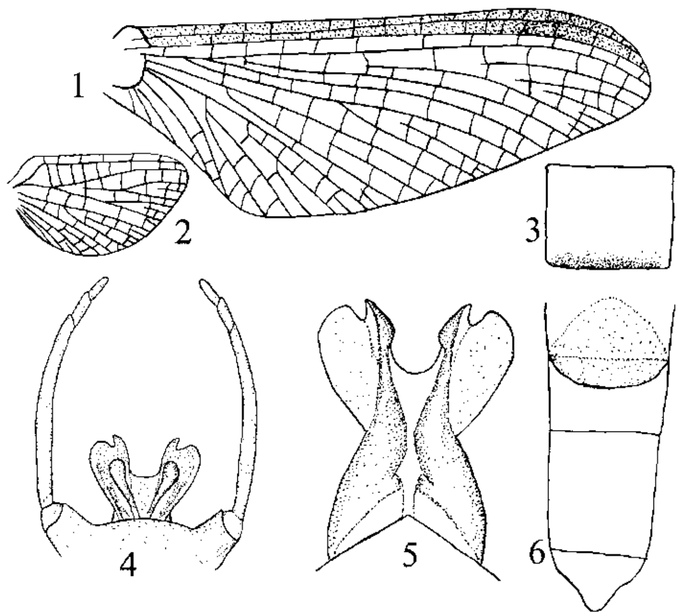
1 *Cinygmina furcata* sp. nov. (Figs. 1 – 6)

Male imago (in alcohol): body length 10.0 – 10.5 mm, forewing 11.0 – 11.5 mm, cerci 34.0 – 37.0 mm. Body pale to pale yellow. Eyes dark, almost contiguous dorsally. Vertex and nota pale yellow, suture yellow to brown. Forewings transparent except stigma region, Sc and R1 cells semihyaline, veins pale, a dark mark at wing base (Fig. 1). Hindwings 3.5 mm, venation as shown in Fig. 2. Forelegs pale, forefemora pale yellow. Ratio of forefemora : tibiae : tarsi = 1.0 : 1.2 : 1.5, order of foretarsal segments in descent is 2, 3, 1, 4, 5, first segment : segment 2 = 1.0 : 1.2. Midlegs and hindlegs pale, tarsi 0.35 times as long as tibiae,

基金项目：国家自然科学基金特殊学科点人才培养基金项目（No. 108）；南京师大博士后基金
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收稿日期 Received：2003-03-10；接受日期 Accepted：2003-04-21

combined length of them same as that of femora. Basal segment of hindtarsi shorter than segment 5 but longer than any other segments. Abdomen pale, posterior margins of terga dark brown (Fig. 3).

Genitalia: forceps with a short basal segment, combined length of segment 3 – 4 less than 0.5 times second one. Subgenital plate with broad emargination; penal lobes divergent, U-shaped cleft between them; apices of penal lobes expanded slightly, location of gonopore concave (Figs. 4 – 5). Each penal lobe has a sclerorized titillator plate ventrally (Fig. 4), median potion of penal lobe ridged dorsally (Fig. 5). Cerci yellowish brown.



Figs. 1 – 6 *Cinygmina furcata* sp. nov.
1. Forewing; 2. Hindwing; 3. Tergum 4; 4. Genitalia (ventral view);
5. Penes (dorsal view); 6. Terminal abdomen of female (ventral view).

Female imago (in alcohol): Body 10.0 mm, forewing 12.0 mm, cerci 35.0 mm. Stergum 7 extending backwards slightly, posterior margin round. Posterior margin of anal plate projected (Fig. 6).

Diagnosis: Among the limited number of species in which adults have been reported, *Cinygmina furcata* sp. nov. relates to *C. hunanensis* and *C. assamensis* because the males of these spp. have similar plate-like titillators. However, the penes of *C. hunanensis* have an obvious median projection between the two penal lobes, while the other two species have no projection, a clear U-shape emargination between the penal lobes. *C. furcata* sp. nov. can be distinguished from *C. assamensis* by the bifurcated apices of the penal lobes.

Etymology: *furcata* (feminine form of Latin word *furcatus*, forked) indicates forked apices of penal lobes and divergence in them.

Materials examined: holotype ♂, San-Mu-Pin (alt. 780 m), Tian-Mu Mountain, Zhejiang Prov., China, leg. ZHAO Ming-Shui on 1998-Ⅶ-29; paratypes: 2 ♂♂ 8 ♀♀, same as holotype, 1999-Ⅶ-26; 1 ♂, same as holotype, 1998-Ⅶ-30; 1 ♂ 2 ♀♀, same as holotype, 1998-Ⅶ-7; San-Li-Tin (640 m), same as holotype, 1998-Ⅷ-4; 40 ♂♂ subimagos, Fu-Tun-Xi, Shao-Wu, Fujian Prov., China, leg. YOU Da-Shou, 1980-Ⅶ-13; 3 ♂♂ subimagos, Da-Zhu-Lan, Huoshan, Anhui Prov., China, leg. YOU Da-Shou and WU Xin-Yong, 1983-V.

2 *Cinygmina hunanensis* Zhang *et* Cai, 1991 (Figs. 11, 15)

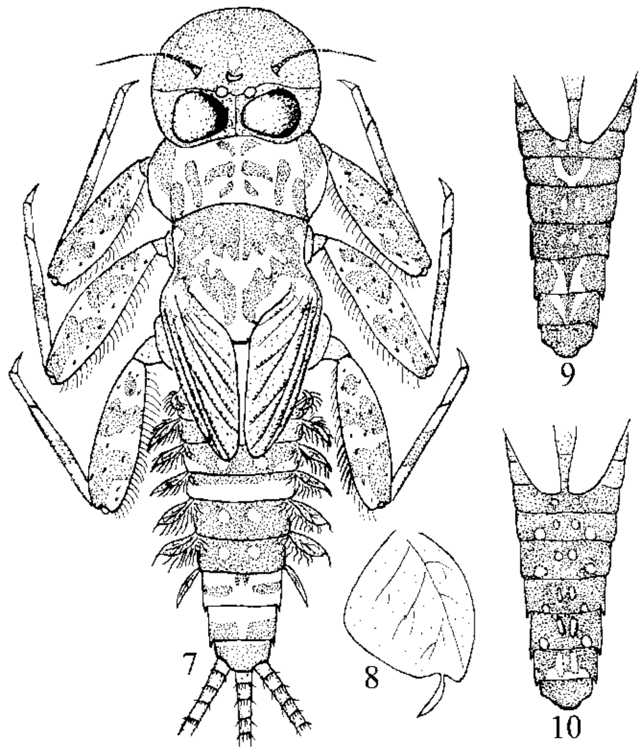
Cinygmina hunanensis Zhang *et* Cai, 1991: 237. Types: male, male subimago, from Hunan Province.

Remarks: As *C. furcata* sp. nov., the male genitalia of this species has plate-like titillators, but the penal lobes are very similar to those of *C. yixingensis*

(Fig. 11). Moreover, the abdominal terga of this species are brown dorsally with dark posterior margins (Fig. 15). The terga of *C*. *yixingensis* are slightly darker than those of this species and have two distinguished longitudinal dark brown stripes (Fig. 18).

Materials examined: ♂ holotype and 9 ♂♂ 3 ♀♀ paratypes, Jing-Bian-Xi, Zhang-Jia-Jie, Hunan Prov., 1986-VI-18, leg. by ZHANG Jun and SHE Shu-Shen; 10 ♂♂ subimagos, same as former, 2001-VIII-17, leg. LI Huo-Hun and ZHANG Rui-Lei.

Distribution: Hunan.



Figs. 7 – 10　Larval characters of *Cinygmina* from China

7 – 8. *C*. *rubromaculata*: 7. Habitus; 8. Lamella of gill 6; 9. Abdominal mark pattern of *C*. *obliquistrita*; 10. Abdominal mark pattern of *C*. *yixingensis*.

3　*Cinygmina obliquistrita* You *et al*., 1981 (Figs. 9, 12, 16)

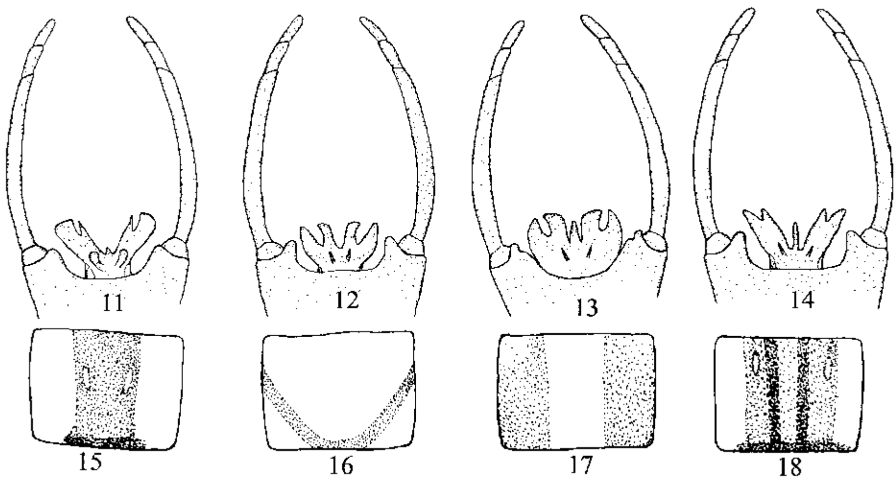
Cinygmina obliquistrita You *et al*., 1981: 26. Types: male, female, from Jiangsu Province.

Cinygmina obliquistrita Wu *et al*., 1986: 65 (larvae description).

Remarks: The imaginal stage of this species can be easily distinguished by their unique oblique brown terga marks (Fig. 16). Moreover, the penal lobes diverge remarkably (Fig. 12). The larva is similar to that of *C*. *rubromaculata*, terga 5, 8 and 9 have distinct pale marks, but are a different shape. Larvae of this species are slightly browner than those of *C*. *rubromaculata*. The abdomen of a larva is as shown in Fig. 9.

Materials examined: ♂ holotype, 13 ♂♂ paratypes, 5 larvae, Ming-Ling, Yi-Xing, Jiangsu Prov., 1980-Ⅶ; 4 ♂♂ 6 ♀♀, Chang-Ming, Gui-Ding, Guizhou Prov., 2000-Ⅸ-9, LI Chuan-Ren and ZHOU Chang-Fa; 5 ♂♂ 10 ♀♀, Sanggang, Wu-Yi Mountain, Fujian Prov., 1995-Ⅶ-10, YING Ling and ZHOU Chang-Fa; 2 ♂♂, Zi-Xi stream, Qian-Shan, Jiangxi Prov., 1993-Ⅶ-18, LU Liang and ZHU Chang-Dong; 15 ♂♂ 10 ♀♀, Huang-Tu-Ken, Anhui Prov., 1996-Ⅴ-1, ZHOU Chang-Fa; 20 ♂♂ subimagos 5 ♀♀, Hongjiang, Hunan Prov., 1985-Ⅶ-21, ZHANG Jun and SHE Shu-Shen.

Distribution: Guizhou, Fujian, Zhejiang, Anhui, Jiangsu, Jiangxi, Hunan.



Figs. 11 – 18 The imaginal characters of *Cinygmina* from China

11 – 14. Male genitalia (ventral view): 11. *C. hunanensis*; 12. *C. obliquistrita*; 13. *C. rubromaculata*; 14. *C. yixingensis*; 15 – 18. Tergum 5 (dorsal view, show mark pattern): 15. *C. hunanensis*; 16. *C. obliquistrita*; 17. *C. rubromaculata*; 18. *C. yixingensis*.

4 *Cinygmina rubromaculata* You *et al*., 1981 (Figs. 7, 13, 17)

Cinygmina rubromaculata You *et al*., 1981: 28, Types: male, female, from Jiangsu Province.

Cinygmina rubromaculata Wu *et al*., 1986: 65 (larvael description).

Cinygmina hainanensis She *et al*., 1995: 72. **Syn. nov**.

Remarks: This species is unique in the genus because of its abdominal pigmentation: median portion of terga pale yellow and reddish laterally (Fig. 17). The male genitalia has an obvious projection between the two penal lobes (Fig. 13). The larvae of this species are larger than those of the other known species and have more pale dots and marks on the body (Fig. 7).

Based on the holotype and paratypes of *C. hainanensis*, we now believe this species be a new synonym of *C. rubromaculata*. In the original description, She *et al*. (1995) reported that they are similar on shape of the genitalia and abdominal color pattern, but the positions of spines on the penes of *C. hainanensis* are different from those of *C. rubromaculata*. However, we believe that the variability in penal lobe positions (they may be divergent greatly or slightly) is such that the spines on their bases can not be used in classification.

Materials examined: ♂ holotype, 48 ♂♂ 27 ♀♀ paratypes, 14 larvae, Mingling, Yixing, Jiangsu Prov., 1980-Ⅶ; 5 ♀♀, Monglun, Mongla, Yunnan Prov., 2001-Ⅷ-24, ZHOU Chang-Fa; 80 ♂♂ 80 ♀♀, Changming, Guiding, Guizhou Prov., 2000-Ⅸ-8, LI Chuan-Ren and ZHOU Chang-Fa; 30 larvae, Baijing, Huishui, Guizhou Prov., 2000-Ⅸ-10, LI Chuan-Ren and Zhou Chang-Fa; 13 ♂♂, Hongjiang, Hunan Prov., 1985-Ⅶ-21, ZHANG Jun and SHE Shu-Shen; 1 ♂ and 4 ♂♂ 7 ♀♀ (holotype and paratypes of *C. hainanensis*), Tongshi, Hainan Prov., 1986-Ⅴ-30, ZHANG Jun and SHE Shu-Shen; 5 ♂♂ 10 ♀♀, Men-Tou-Gou, Beijing, 2001-Ⅸ-25, ZHOU Chang-Fa.

Distribution: Southern, eastern and northern China; Russian Far East.

5 *Cinygmina yixingensis* Wu *et* You, 1986 (Figs. 10, 14, 18)

Cinygmina yixingensis Wu *et* You, 1986: 280. Types: male, female, from Jiangsu Province.

Cinygmina yixingensis Wu *et al*., 1986: 66 (larvae description).

Remarks: Male of this species has a distinct finger-like projection between divergent penal lobes (Fig. 14); terga of adults with a darker median potion and posterior margin, two longitudinal stripes can be distinguished (Fig. 18). The larvae are browner than those of *C. rubromaculata*, and possess fewer pale dots and marks, terga with some regular pale dots (Fig. 10). The mature male larvae can be identified by color pattern and darker dorsal terga.

Materials examined: ♂ holotype, 10 ♂♂ 6 ♀♀ 2

♂♂ subimagos paratypes, 10 larvae, Mingling, Yixing, Jiangsu Prov., 1980-Ⅶ; 10 ♂♂ 15 ♀♀ 100 larvae, Fengshan, Jinggu, Yunnan Prov., 2001-Ⅳ-6, ZHOU Chang-Fa; 1 ♀ subimago (reared from larva), Longjie, Jingdong, Yunnan Prov., 2001-Ⅳ-12, ZHOU Chang-Fa; 50 ♂♂ 50 ♀♀ 100 larvae, Changming, Guiding, Guizhou Prov., 2000-Ⅸ-8, LI Chuan-Ren and ZHOU Chang-Fa; 14 ♂♂ 8 ♀♀, Maoyang, Hainan Prov., 1986-Ⅴ-31, ZHANG Jun and SHE Shu-Shen; 100 ♂♂ 100 ♀♀ ♂♂, Laibang, Huoshan, Anhui Prov., 1983-Ⅵ, YOU Da-Shou; 3 ♂♂ 5 ♀♀, Men-Tou-Gou, Beijing, 2001-Ⅸ-25, ZHOU Chang-Fa.

Distribution: Hainan, Yunnan, Guizhou, Zhejiang, Fujian, Jiangxi, Hunan, Jiangsu, Anhui, Henan, Beijing.

Key to Chinese species (male imago)

1. Penes with plate-like titillators (Figs. 4, 11) ······ 2
   Penes without titillators but with sharp spines (Figs. 12–14) ······ 3
2. Penes without median projection between penal lobes (Fig. 4); posterior margins of terga dark brown (Fig. 3) ······ ***C. furcata* sp. nov.**
   Penes with clear median projection between penal lobes (Fig. 11); posterior margins and median portions of terga dark brown (Fig. 15) ······ ***C. hunanensis***
3. Abdominal terga each with a pair of clear oblique brown stripes (Fig. 16) ······ ***C. obliquistrita***
   Abdomen without oblique stripes ······ 4
4. Abdominal terga with reddish pigmentations laterally (Fig. 17) ······ ***C. rubromaculata***
   Abdominal terga with median dark brown pigmentations dorsally (Fig. 18) ······ ***C. yixingensis***

Key to larvae of Chinese species

1. Abdominal terga 5, 8, 9 pale, with yellowish brown dots (Figs. 7, 9) ······ 2
   Abdominal terga 5, 8, 9 yellowish brown, with regular pairs of pale dots (Fig. 10) ······ ***C. yixingensis***
2. Body with distinct large pale dots and markings dorsally (Fig. 7) ······ ***C. rubromaculata***
   Body with small pale dots and markings dorsally (Fig. 9) ······ ***C. obliquistrita***

Acknowledgements We are indebted to Dr. DU Yu-Zhou (Yangzhou University), Dr. WANG Bei-Xing (Nanjing Agricultural University) and LI Chuan-Ren (Hubei Agricultural College) for their help in field collection and providing some specimens.

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中国似动蜉属及一新种记述

（蜉蝣目：扁蜉科）

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摘要：似动蜉属 *Cinygmina* 是我国常见扁蜉科类群，分布广泛。本文对该属我国已知4种（湖南似动蜉 *C. hunanensis*，斜纹似动蜉 *C. obliquistrita*，红斑似动蜉 *C. rubromaculata*，宜兴似动蜉 *C. yixingensis*）和一新种（叉似动蜉 *Cinygmina furcata* sp. nov.）的鉴别特征作了对比和图示，并确认海南似动蜉 *C. hainanensis* 是红斑似动蜉 *C. rubromaculata* 的同物异名（新异名）。

关键词：蜉蝣目；扁蜉科；似动蜉属；新种；新异名；中国

中图分类号：Q969 **文献标识码**：A **文章编号**：0454-6296（2003）06-0755-06